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ABSTRACT

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Visitor Understanding of Interactive Exhibits: A Study of Family Groups in a Public Aquarium

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A paper presented at the National Association for Research in Science Teaching meetings, March-April, 1996

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ABSTRACT

VISITOR UNDERSTANDING OF INTERACTIVE EXHIBITS: A STUDY OF FAMILY GROUPS IN A PUBLIC AQUARIUM

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The purpose of this study was to determine the effectiveness of five interactive exhibits in the New Orleans Aquarium of the Americas. The specific research questions were: Which interactive displays in the "Living in Water" exhibit are most memorable to families?; What aspects of these displays seem to increase learning in families?; and What types of knowledge presented in the exhibit are most memorable? Fourteen family groups were tracked as they visited the displays. They were then interviewed. One to two months later, families were called for follow-up interviews. All interviews were recorded and transcribed. Displays fell into three categories: the *touch pool* and *electric eel* displays were remembered very well on both the short and long term; *noisemakers* and the *shark shapes* displays were remembered reasonably well on the short term, but not as well in the long term; and the *eye-to-eye* exhibit was somewhat remembered on the short term and remembered very poorly on the long term. Some exhibits, though memorable, also helped foster misconceptions. Correct perceptions as well as misconceptions remained quite stable between the two interviews. Principle differences between the memorable and non-memorable exhibits seemed to involve differences in the exhibits' emotional impact. Visitors usually remembered what they had done, but did not always relate that to the theme of the display. If we develop exhibits with a high emotional impact and with interactive elements closely related to the concept we wish to relate, we will be more successful at communicating our message to visitors.

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Visitor Understanding of Interactive Exhibits:
A Study of Family Groups in a Public Aquarium

What is Museum Learning?

The Project 2061 publication entitled Science for All Americans (AAAS, 1989a), focuses on the educational goal of scientific literacy for all U. S. citizens. A related publication acknowledges the lack of successful science education practices, not only in the nation's schools, but also in its homes (AAAS, 1989b). In it, the panel argues that biology cannot be learned and appreciated primarily through books, computerized courses, or television programs. First, it must be experienced.

People need opportunities for intimate contact with the living world. Informal learning provides a multitude of opportunities for learning throughout our lives. It is unrestricted in that there is no set curriculum to cover or to confine us. Informal learning is the primary way people obtain new information once they have left the formal school setting. In view of the rate at which our society is changing today, we need to continue educating everyone, even those who have completed their formal education. Understanding how people learn in informal settings may hold one key to creating a scientifically literate society.

Educational theory states that knowledge is constructed. Individuals learn when they modify existing conceptual structures, creating new links and integrating new concepts. In order to learn meaningfully, a person must choose to integrate new knowledge (meeting criteria of excellence) into his or her conceptual structure, relating the new material to pre-existing knowledge and experiences (Novak & Gowin, 1984). Falk and Dierking (1992) suggest that "museums are excellent environments for meaningful learning because they offer rich, multi-sensory experiences" (p. 114). These environments offer an intimate involvement with perceptible and tangible objects, creating an impetus for change in the personal meaning of experience.

Excellence and Equity: Education and the Public Dimension of Museums (AAM, 1992) is the first major report focusing on museums' educational role to be issued by the American Association of Museums. The report has become a focal point for the museum education community, encouraging museum professionals to increase the effectiveness of informal education by reaching out to diverse audiences in new ways. Museums can contribute to both formal and informal education at every stage of life, from preschooler to adult. Along with this capacity comes a museum's responsibility to educate effectively.

The precise meaning of the word "learning" is ill-defined in the museum setting. (We prefer Novak and Gowin's: "a change in the meaning of experience.") Much of the learning that goes on is assumed to be affective, involving feelings and senses. This does not, however, mean that there are no cognitive gains. Hilke (1988) has shown that visitors are more likely to follow their own agendas than to recognize and accept the exhibit theme intended by the designers. Thus, visitors may well be learning cognitively, but just not in the areas we might predict. Javlekar (1989) found that 7th-grade students learned better in an interactive museum setting than in a traditional classroom lecture and demonstration. Museums may also provide a background of experiences on which cognitive gains can be made at a later time.

Some studies naively suggest that if visitors remain in the exhibit vicinity and pay attention to the objects and events depicted, those visitors will learn. But this assumption does not help museum educators find realistic ways to increase visitor learning. We must understand how and what visitors learn from a museum experience. Clearly there is too much complexity to yield a single answer to the question "What is museum learning?".

Families as Social Units of Learning

Falk and Dierking (1992) suggest that theories have often neglected the social nature of learning. Dierking (1989) reports that a study by Alt showed 70% of the visitors to the British Museum (Natural History) came in social groups other than school groups. Sixty percent of these groups were family groups. Similar patterns have been found in the U.S., though as Dierking notes, little research has focused on these important groups.

According to Dierking (1989), families want to perform a variety of activities while at a museum. She notes that it is not clear as to whether these activities result in learning, although her opinion is that families learn a great deal -- but much of it is very different than that intended by the designers.

Hilke (1988) argues that families have been in the business of learning together for many years. Visitors tended to pursue their personal strategies over cooperative strategies, although they were still bound to the group, and they broadcast information to other group members. Visitors pursued their personal agendas rather than following the theme of the exhibition. Instead of focusing on relationships between various parts of the exhibition, visitors sought relationships to their own knowledge and experiences. Hilke argues that designers must

anticipate the common questions and interests of the visitors in order to be successful in designing exhibits.

How Can We Tell If They've Learned Something?

Many museum studies now recommend the use of open-ended interviews to probe visitor experiences. Falk and Dierking (1990) recommend these interviews, particularly after days, months, or years, to provide insight into the meaningful learning that may occur in museums. Chambers (1994) stresses the need for evaluation studies, including qualitative studies. She argues we need to stop trying to control the specifics, focusing on what our visitors are actually learning rather than on what we (museum professionals) are trying to relay. Schloder (1994) and Dierking (1994) state that observations are not enough. We need to employ qualitative methods in order to understand the quantitative trends we see. Lord (1994) argued that most international museum studies have focused on quantitative data to understand the cognitive experience. Science centers were particularly prone to focus on the cognitive at the expense of the affective experience.

Research Questions

This study sought to understand the learning that takes place in an informal environment. In particular, we attempted to learn the impact interactive exhibits have on the family experience at a public aquarium. To this end, we developed the following research questions:

1. Which interactive displays in the "Living in Water" exhibit are most memorable to families?
2. What aspects of these exhibits seem to increase learning in families?
3. What types of knowledge presented in the exhibit are most memorable?

Methods

Family groups were observed as they passed through the "Living in Water" exhibit at the New Orleans Aquarium of the Americas. We chose the Aquarium of the Americas for this study because it is one of the top aquaria in the nation. It serves 1.5 million visitors each year, and 26% of its annual budget goes toward education. The Aquarium has five large exhibit areas that were developed according to generally accepted guidelines of effectiveness. We selected the "Living

in Water" exhibit because of its focus on smaller and more interactive displays, organization into themes, and proximity to rest areas.

The "Living in Water" exhibit consists of five interactive and a number of non-interactive displays. The interactive exhibits are scattered throughout the display area, and visitors can explore the entire area freely. The five interactives include: *eye-to-eye*, where visitors look through a inverted bubble shaped lense resembling the eye of the 4-eyed fish; *noisemakers*, which consists of buttons visitors can push to hear different fish sounds; electric eels *finger tingler* where visitors turn a knob to shock themselves; *a shape for all reasons* which has doors visitors can lift to expose shark photos and cartoon representations of them based on their strange names (e.g. a goblin sharks dressed up for Halloween); and the *touch tank*, in which visitors can pet a baby nurse shark.

Fourteen families were selected based on their size and make-up. All families selected had one or two adults and two children between the ages of 5 and 13. Only families who spent a reasonable amount of time looking at and interacting with the displays were included in this study. Visitors were observed at each of the interactives. A researcher noted such things as the amount of time spent at each display, what the families did, and whether there was any discussion.

After the families had completed their tour of the exhibit, a researcher approached them and requested an interview. The interviews were open ended and contained questions such as "what did you visit?", "what do you remember?", "did the exhibit remind you of anything you were already familiar with?", and "what did you see?" Visitors were allowed to discuss any aspects they remembered from the entire display, but only their comments regarding the interactive exhibits were included in this study.

One to two months after the original interviews, one of the researchers called each family for a follow-up interview. Family members were asked similar questions to those in their first interview, but were allowed to discuss anything they remembered from the entire Aquarium, as they were often unable to recall whether a particular exhibit was in the study area.

Initial interviews were conducted with all family members simultaneously, allowing for interaction between individuals. Follow-up interviews, however, were conducted with each family member individually. Both sets of interviews were taped and transcribed for analysis.

Analysis of the data consisted of noting which interactive exhibits family members remembered and what kind of information they remembered about each.

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Recollections were grouped into three categories: ability to remember and describe some aspect of the exhibit (i.e. remembering lifting up doors for more information), ability to name the fish involved in the exhibit, and ability to describe some information they learned from the exhibit (other than a name). Short-term and long-term memories were analyzed separately.

Visitors' memories were compared to characteristics of each of the interactive exhibits, and characteristics which seem to increase visitor recollection were identified.

Results

There was a large discrepancy in visitors' recollections of the various displays. All of the families mentioned the *touch tank* during the first interview, but only half recalled *eye-to-eye*. The trends were even more pronounced in the second interview, where all still remembered the *touch tank*, but only 14.3% mentioned *eye-to-eye*. Table 1 shows the percentages of families that mentioned each of the displays. The follow-up interviews were clearly significant to this study, as evidenced by the large differences in people's recollections of certain displays between the first and second interviews. Not only are the values themselves different for the different displays, but the varying amounts of change are highly suggestive of differences in learning that might result from different types of displays.

Displays seemed to partition into three groups: the *touch tank* and *electric eel* displays were clearly the most memorable. Nearly everyone remembered them on both the long and short term retention probes. The *shark shapes* and *noisemakers* displays were not quite as memorable on the short term, having 80% and 66.7% of families mention them respectively. About one of every three or four families that discussed them in the first interview did not remember them in the second. *Eye-to-eye* scored the worst, with only half the families recalling it during the first interview and only one out of four of those mentioning it during the second interview.

Most of these displays are not complicated interactives. They consist of pushing a button, lifting a door, turning a knob, or looking into a tank through a concave bubble. Clearly, however, the exhibits do not have to be extremely fancy to be memorable.

Table 2 shows the different senses and emotions involved with each of the exhibits. All of the displays but *eye-to-eye* involve more than just sight. The others

each involve three senses or emotions. The two that had the highest recall, the *touch tank* and the *electric eel*, both involved fear. Many visitors, particularly the children, expressed fear about touching the shark, worried that they might be bitten (although one child explained that a dentist had removed the shark's teeth so it couldn't bite). Visitors to the *eel* display turned a knob to give themselves a mild electric shock, but they were often worried about it hurting and some were afraid to try it. The strong emotions involved with this fear appear to make these exhibits highly memorable.

Humor also appears to be an emotional element that can increase learning. However, it did not affect learning as much as fear. The *shark shapes* exhibit and *noisemakers* both involved sight and touch, but the shape exhibit added humor, while the *noisemakers* included sound. The shape exhibit was also more memorable than the *noisemakers* on the short term, but recollection of it dropped to the same as *noisemakers* by the second interview.

Groups remembered different things about different displays. Often visitors could describe exhibits and what they had done, but they did not always understand the underlying concept. Almost every group remembered shocking themselves, and most remembered that the shock was in conjunction with the *electric eel* display. Half of the groups, however, mistakenly believed they had received a shock equal to that given by an eel! This misconception proved to be quite stable, as the same groups that believed they had been shocked with the full power of an eel during the first interview still believed this during the subsequent interview. Likewise, groups who understood they had only received a mild shock also retained this understanding in the second interview. Another interesting aspect of the *eel* display was that it seemed to facilitate experimentation and additional learning more than the other displays. Three families described information not mentioned in the exhibit, and two of these were the result of experimentation with the display.

The *touch tank* was remembered by all the groups. Most of the visitors described touching a shark, but generally, they were unable to correctly identify the kind of shark they touched (a nurse shark). They were, however, able to describe various aspects of the shark, such as its color, size, or texture. Again, these memories seemed to be quite stable. Visitors who had remembered details in the first interview also did during the follow-up; rarely did anyone mention something during the second interview if he or she had not mentioned it in the first.

The *shark shapes* exhibit was unusual in that visitors were more likely to describe something they learned than to describe the actual exhibit. In addition, the groups

that could remember the names of the sharks could almost always remember additional information about them. This is reasonable, since the cartoon renditions generally highlighted some aspect of the animals. Hammerheads were depicted hammering their oddly-shaped heads into the side of a boat, and guitar sharks were shown as guitars lying on the bottom of the sea. These cartoons evidently were memorable enough that visitors remembered both the name and appearance of the sharks. Children especially would describe the cartoon appearance and then relate it to the actual appearance of the animal.

Noisemakers is a basic exhibit with a basic idea. Most visitors who remembered it understood the idea behind the display. Often, however, groups would remember their own actions (pushing a button), but not the specific results (what fish made the sound). Again, visitors who remembered details during the first interview were generally the same ones who remembered them in the subsequent interview.

Eye-to-eye was the most poorly remembered display on both the long and short term. Recollections seemed to drop off faster on the long term than for other exhibits. Only half of the visitors who described the display actually understood it. Perhaps an oddly-shaped case did not seem unusual enough for visitors to wonder the reason for that shape. Many people believed they were merely getting the chance to place their heads further into a tank. They did not understand that by looking through the bubble, they could get the effect of looking both above and below the water simultaneously, just as the fish they were watching did. This is the aspect of the exhibit that makes it interactive. If visitors do not perceive that, the exhibit would appear to be just another non-interactive. Perhaps the decreased recollection of this exhibit is partially due to this misperception. One possible solution would be to include a sound system that visitors could hear when they put their heads into the bubble. A voice could direct them to observe both above and below the water, pointing out that because of this ability, the fish they are watching can be more aware of its surroundings.

Implications

Museums have realized for several years that visitors gain more from interactive exhibits than static ones. This study supports the theory that interactives can be memorable, but it also suggests that the mere fact an exhibit is interactive does not mean it will be educational. Exhibits that involve multiple senses and strong emotions appear to be more memorable. By designing exhibits that have

these characteristics, we may be able to increase visitor learning on both the long and the short term.

The interactive portion of exhibits should be tied as closely as possible to the actual knowledge we wish to convey. Visitors were often able to recall what they did, but they did not know the scientific point of the exhibit. In fact, some of the exhibits seemed prone to visitor misinterpretation. Although correct information was presented, visitors only remembered disjoint pieces that sometimes led to a misconception. For instance, although the *eel* exhibit was memorable, too many visitors left believing they had felt what an electric eel shock feels like. Perhaps the exhibit could be modified to include some scale on which to read the shock the visitors gave themselves. Other currents could be marked on the scale for comparison, including such things as a household current, an eel shock, and a lightening bolt. This might give visitors a better idea of the power behind the shock of an electric eel. As visitors conceptions of the exhibits, whether correct or incorrect, appear to be quite stable over time, we need to be especially cogniscent of what information we are conveying.

Visitors continue to pursue their own agendas as they visit informal learning institutions, but they also pay attention to exhibits and remember some of the information portrayed there. Perhaps if we can explicitly link exhibits to the visitors, providing meaningful experiences that relate closely and accurately to the information we wish to convey, we will be more successful in our educational roles. Although we may overwhelm visitors if every exhibit creates shock or fear, we may be able to use a few of these emotion-inducing exhibits to open a door for further learning. Visitors will continue to pursue their own agendas during their museum visits, but careful preparation of exhibits may enable us to focus their attention, arouse significant questions, and enhance learning.

The family group appears to be an effective learning unit. As families explore exhibits, they often spend more time at specific exhibits than do school children. Parents generally talk to their children about the displays, sharing experiences, answering questions, and explaining interesting tidbits of knowledge. School children are often in larger groups where they do not have as much adult interaction. They are usually more limited on time, and the adults available may not know the children well enough to remind them of experiences and knowledge that might be linked to information found in the exhibit. As informal educators, we often cater to school groups, attempting to create effective learning situations for students. After all, this is a large audience, and we usually know when to expect

them, whereas families visits are often unscheduled. School groups also are nice for the statistician, since they rapidly increase our numbers and apparent affect. Families, however, may well create a more productive learning environment. By developing more programs geared toward families, we may have a more significant impact on all our visitors.

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Table 1: Percentage of families that mentioned displays

Displays	1st interview	2nd interview
eye-to-eye	50%	14.3%
noisemakers	66.7%	50%
electric eel	92.3%	92.3%
touch tank	100%	100%
shapes	80%	50%

Table 2: senses and emotions involved in displays

	sight	hearing	touch	fear	humor
eye-to-eye	X				
noise	X	X	X		
electric eel	X		X	X	
touch tank	X		X	X	
shapes	X		X		X